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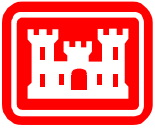
# Coastal Structures Asset Management Workshop Chicago, Illinois – June 19<sup>th</sup>, 2008

## *Coastal Structures Management, Analysis, and Ranking Tool* **CSMART**

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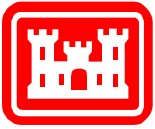


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# Coastal Structures Asset Management

- Tens of Millions \$ spent each year repairing structures.
- Districts, Divisions, and HQ need rational and consistent methods for managing O&M expenditures on critical coastal infrastructure.
- High-level, portfolio-wide rankings of structures requires a tool for collating large amounts of data.





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# Coastal Inlets Research Program CSAM Work unit

- CIRP PM: Dr. Nick Kraus
- CSAM WU Strategic Objectives: Provide decision-support tools to all levels of Corps management concerning maintenance and rehabilitation funding for coastal jetty and breakwater structures.
- Overarching vision: *optimally prioritize* O&M funding such that benefits to the Nation are maximized and decisions can be defended.





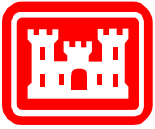
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# Coastal Structures Asset Management

- Multiple measures of significance:
  - Supported economic activity
  - Life safety & storm protection
  - Military and national security value
  - Environmental benefits
- Portfolio-wide AM demands *surrogate metrics* that correlate with the true significance and can be collected and tabulated quickly.





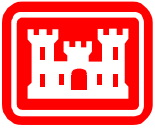


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# Decision-Support Tool

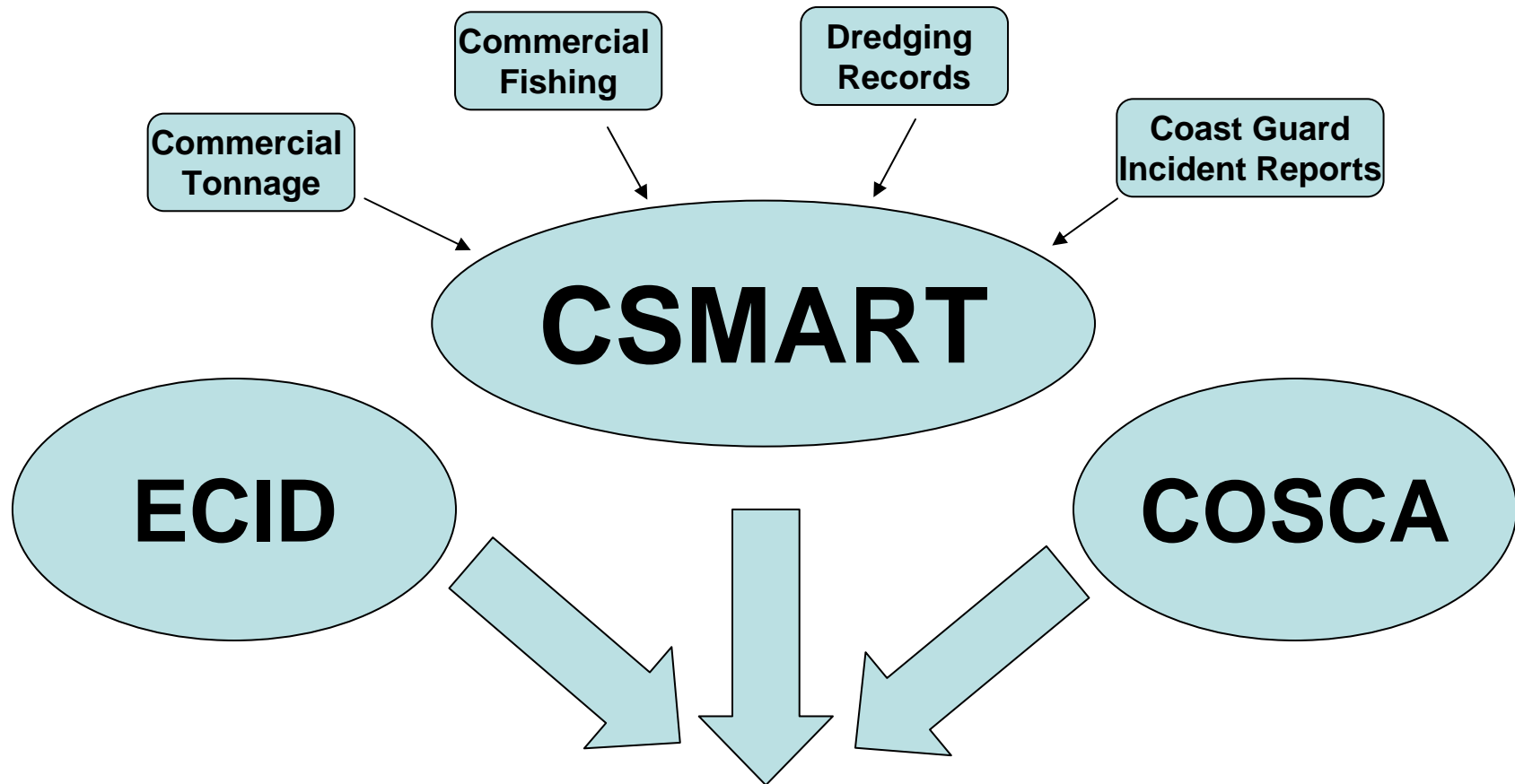
- Separate from the issue of which significance metrics to consider, a tool is needed to sort and filter the pertinent data and produce a prioritized ranking of structures.
- Some data already available
  - Commercial tonnage (NDC)
  - Commercial fishing (NOAA-NMFS)
  - Coast Guard incident reports
  - USACE Dredging records (NDC)
  - Cruise and ferry statistics (USDOT)
- Some data still need to be gathered
  - Recreation
  - Environmental benefit





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# Decision-Support Tool



***Prioritized Listing***



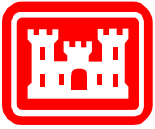
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# Tonnage Support



2413 - CHANNEL TO ARANSAS PASS, TX  
2414 - CORPUS CHRISTI, TX  
2423 - CORPUS CHRISTI SHIP CHANNEL, TX (CORPUS CHRISTI AND HARBOR ISLAND, TX)  
6244 - GULF INTRACOASTAL WATERWAY, GALVESTON TO CORPUS CHRISTI, TX  
6921 - TOTAL WATERBORNE COMMERCE OF THE CORPUS CHRISTI BAY AREA



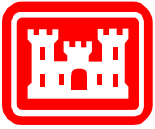


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# Tonnage Support

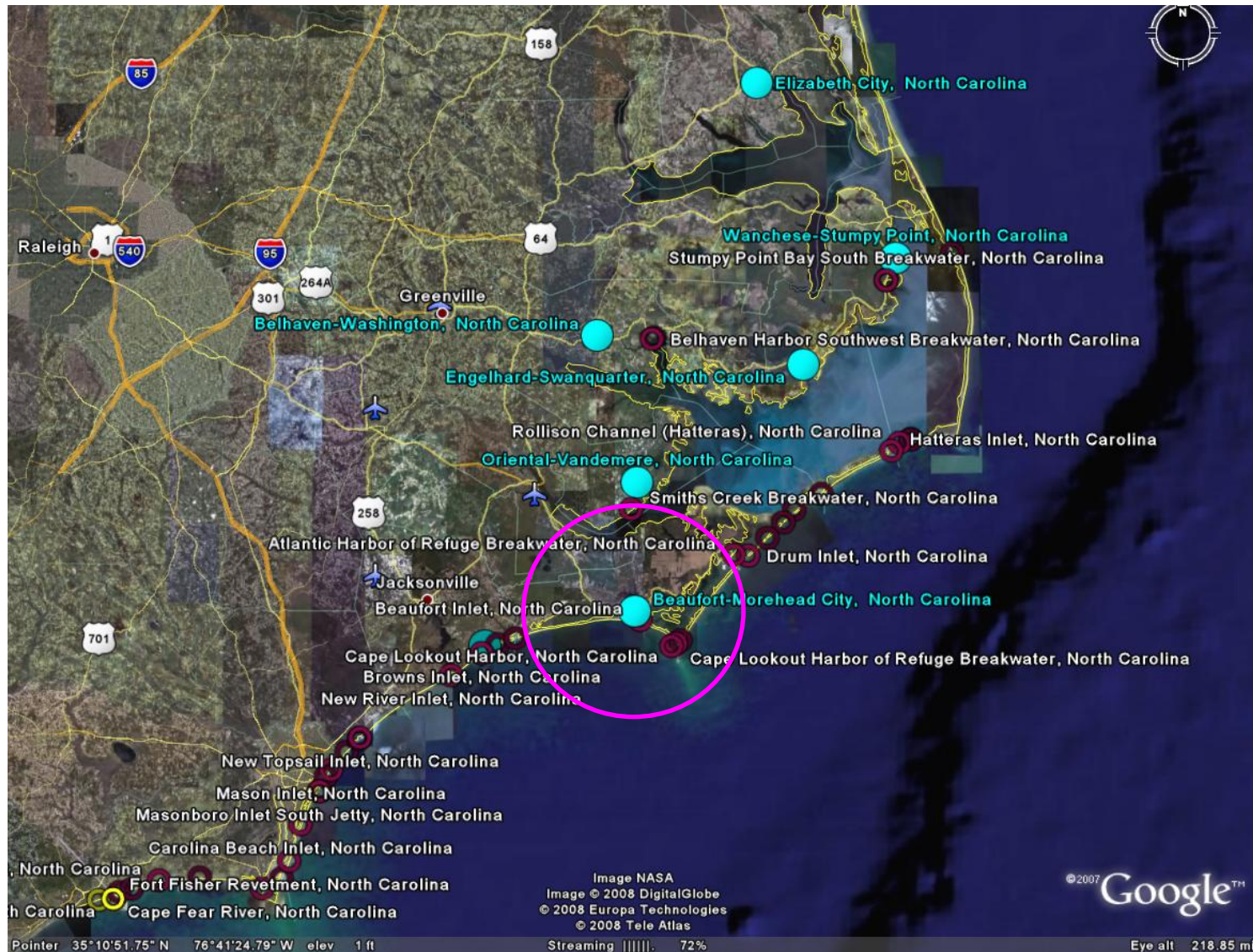
- Not all structures support tonnage
- NDC compiles tonnage statistics for over 2800 coded waterways annually
- Corps coastal structures (from ECID) are hard-linked to waterways they support
- Jetties often support tonnage in multiple waterways ~ system considerations
- We typically include only coastwise and lakewise tonnage when ranking coastal structures



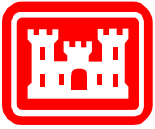


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# Commercial Fishing

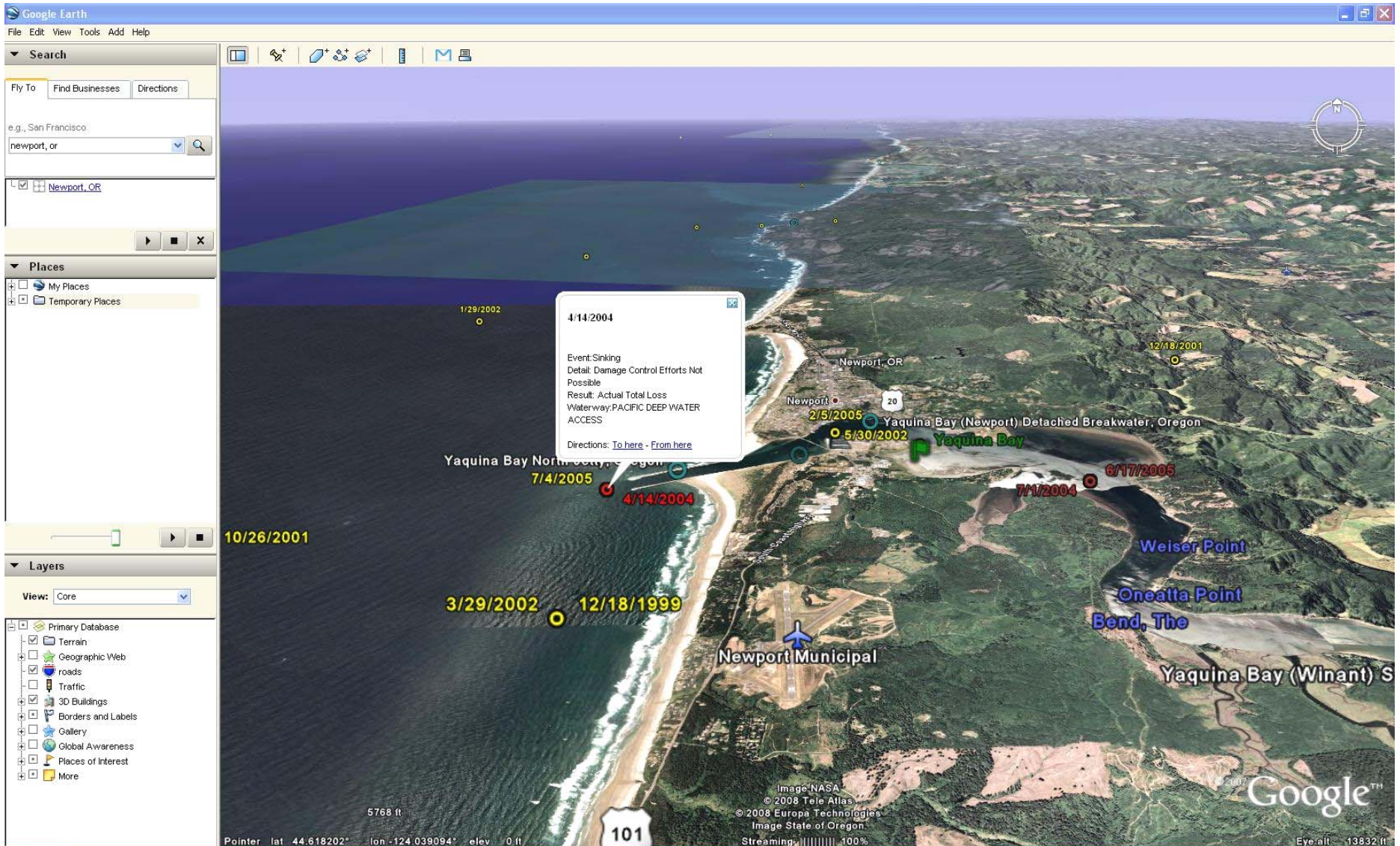


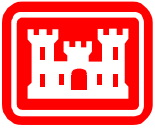




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# Safety Considerations



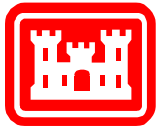


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# Sample Queries

- Which project in my District supported the most petroleum imports over the last 5 years?
- Which District in my Division spent the most on dredging in 2004?
- Where are the “hot spot” structures in my District for Coast Guard incidents, and what are the primary incident types?
- Which structures support the most commercial fishing nation-wide?
- Which project on the west coast supported the most domestic tonnage, and what were the leading commodities last year?
- What were the top 20 commodities at the largest tonnage project in my District over the last 5 years?





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# Tonnage Supported

**CSMART**

Step 1: Features | Step 2: Locations | Step 3: Execute Query | Step 4: View Results | Step 5: Google Earth

Commercial Tonnage | Commercial Fishing | Coast Guard | Dredging | Boat Ramp

☒ Include?

**Movement**

**In/Out**

☐ Inbound Tonnage  
☐ Outbound Tonnage  
☒ Both

**Foreign/Domestic**

☐ Foreign Tonnage  
☐ Domestic Tonnage  
☒ Both

**Years**

1993  
1994  
1995  
1996  
1997  
1998  
1999  
2000

Selected Years

2005  
2004  
2003  
2002

**Commodities**

Category

ALL COMMODITIES

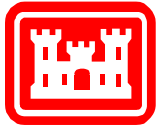
Acyclic Hydrocarbons  
Aircraft & Parts  
Alcohols  
Aluminum  
Ammonia  
Animal Feed, Prep.  
Animals & Prod. NEC  
Asphalt, Tar & Pitch  
Bananas & Plantains

Selected Commodities

Alcoholic Beverages  
Aluminum Ore  
Coal Coke  
Corn  
Crude Petroleum  
Gasoline  
Iron Ore  
Pesticides  
Wheat

**Query Type**

☒ Cumulative  
☐ Average



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# Commercial Fishing

**CSMART**

Step 1: Features | Step 2: Locations | Step 3: Execute Query | Step 4: View Results | Step 5: Google Earth

Commercial Tonnage | **Commercial Fishing** | Coast Guard | Dredging | Boat Ramp

☒ Include?

Output Value

☐ Pounds

☒ Dollars

☒ Use today's dollars?

Rate  %

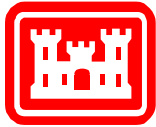
Query Type

☒ Cumulative

☐ Average

Years

1981	>>	2001
1982		2002
1983	<<	2003
1984		2004
1985		2005
1986		2006
1987		
1988		



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# Coast Guard Incidents

**CSMART**

Step 1: Features | Step 2: Locations | Step 3: Execute Query | Step 4: View Results | Step 5: Google Earth

Commercial Tonnage | Commercial Fishing | **Coast Guard** | Dredging | Boat Ramp

☒ Include?

Search Radius (miles)  
1

Injury Reports

Selected Injuries

Dead  
Injured  
Missing

Years

Selected Years

2003  
2004  
2005  
2006

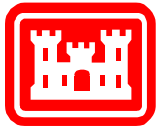
Vessel Events

Selected Events

Abandonment  
Blowout  
Damage to Cargo  
Damage to the Environment  
Explosion  
Fire  
Flooding  
Fouling  
Garbage Discharge  
Loss of Electrical Power  
Loss of Stability  
Material Failure (Diving)  
Material Failure (Non-vessels)  
Material Failure (Vessels)

Allision  
Capsize  
Collision  
Emergency Response  
Evasive Maneuvers  
Grounding  
Sinking  
Vessel Maneuverability





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# Dredging

**CSMART**

Step 1: Features | Step 2: Locations | Step 3: Execute Query | Step 4: View Results | Step 5: Google Earth

Commercial Tonnage | Commercial Fishing | Coast Guard | **Dredging** | Boat Ramp

☒ Include?

**Output Value**

☐ Cubic Yards

☒ Dollars

☒ Use today's dollars?

Rate  %

**Query Type**

☒ Cumulative

☐ Average

**Years**

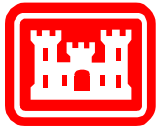
1990 1991 1992 1993 1994 1995 1996 1997

>> <<

**Selected Years**

2004 2005 2006 2007

**Search Radius (miles)**



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# Tonnage Results

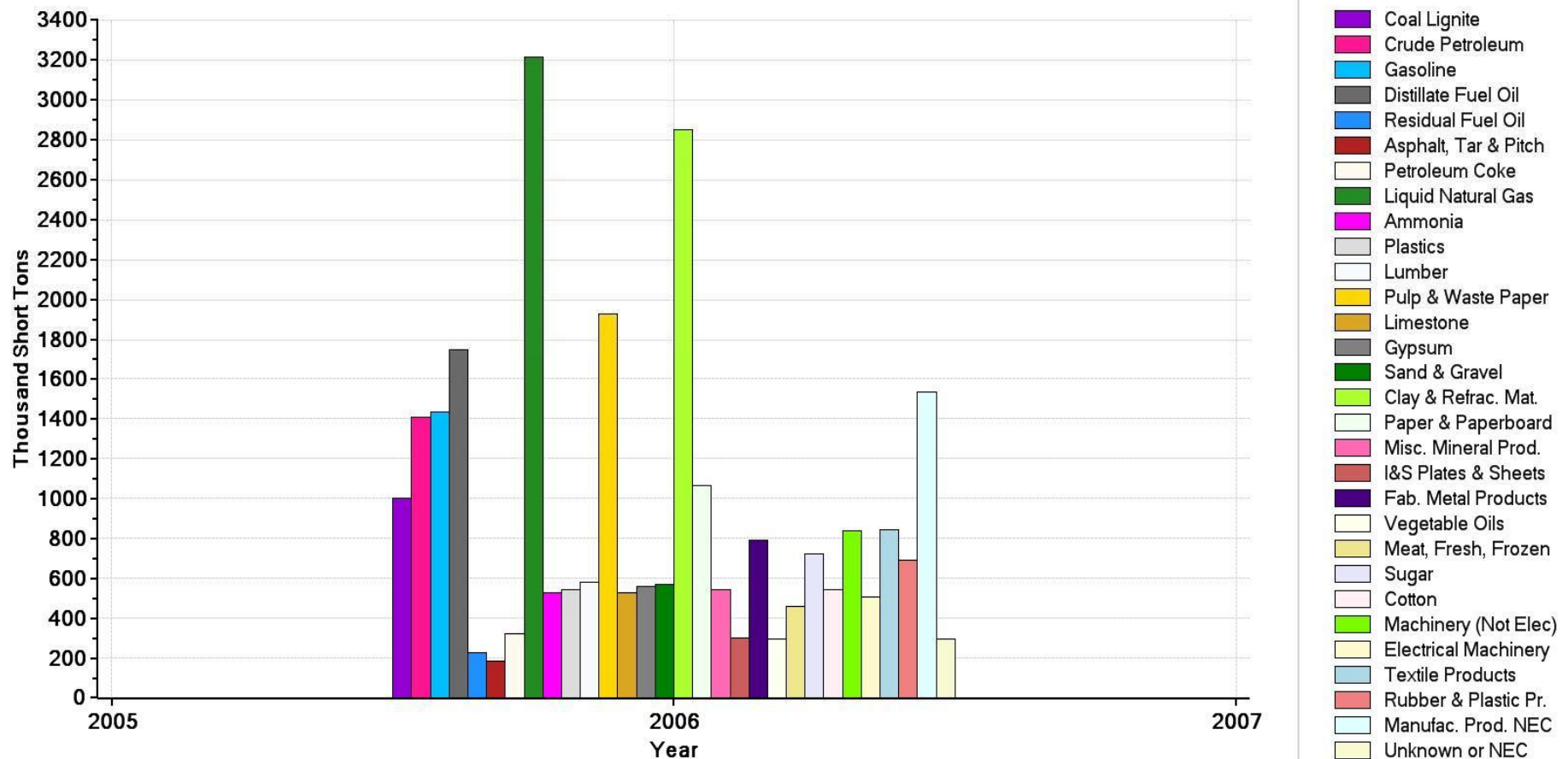
CSMART						
Step 1: Features Step 2: Locations Step 3: Execute Query Step 4: View Results Step 5: Google Earth Preferences						
Tonnage	Fishing	Coast Guard	Dredging	Boat Ramp	Global Ranking	
Details	State	Project	Structure	Thousand Short Tons	Ranking	Co
	LOUISIANA	1 SOUTHWEST PASS	SOUTHWEST PASS EAST JETTY	1,037,252	1	
			SOUTHWEST PASS WEST JETTY		2	
	TEXAS	2 GALVESTON ENTRANCE	GALVESTON HARBOR NORTH JETTY	998,556	3	
			GALVESTON HARBOR SOUTH JETTY		4	
	CALIFORNIA	3 LA-LB HARBORS	LA-LB HARBORS LONG BEACH BREAKWATER	646,470	5	
			LA-LB HARBORS MIDDLE BREAKWATER		6	
			LA-LB HARBORS SAN PEDRO BREAKWATER		7	
	TEXAS	4 SABINE PASS	SABINE PASS EAST JETTY	439,189	8	
			SABINE PASS WEST JETTY		9	
		5 ARANSAS PASS	ARANAS PASS NORTH JETTY	306,328	10	
			ARANAS PASS SOUTH JETTY		11	
	MINNESOTA	6 DULUTH SUPERIOR HARBOR	DULUTH SUPERIOR HARBOR (DULUTH SHIP		12	
			DULUTH SUPERIOR HARBOR (DULUTH SHIP	219,248	13	
	MINNESOTA AND WISCONSIN		DULUTH SUPERIOR HARBOR (SUPERIOR EN		14	
			DULUTH SUPERIOR HARBOR (SUPERIOR EN		15	
	LOUISIANA	7 CALCASIEU RIVER AND PASS	CALCASIEU PASS EAST JETTY	181,173	16	
			CALCASIEU PASS WEST JETTY		17	
	OREGON AND WASHINGTON	8 COLUMBIA RIVER AT MOUTH	COLUMBIA RIVER AT MOUTH JETTY A	155,115	18	
			COLUMBIA RIVER AT MOUTH NORTH JETTY		19	
			COLUMBIA RIVER AT MOUTH SOUTH JETTY		20	
	MAINE	9 PORTLAND HARBOR	PORTLAND HARBOR NORTH (INNER HARBOR)	139,828	21	
			PORTLAND HARBOR SOUTH (SPRING POINT)		22	
	TEXAS	10 FREEPORT HARBOR	FREEPORT HARBOR NORTH JETTY	133,757	23	
			FREEPORT HARBOR SOUTH JETTY		24	
	SOUTH CAROLINA	11 SAVANNAH HARBOR	SAVANNAH HARBOR COCKSPUR JETTY	133,168	25	
			SAVANNAH HARBOR OYSTER BED JETTY		26	
		12 CHARLESTON HARBOR	CHARLESTON HARBOR NORTH JETTY	119,630	27	
			CHARLESTON HARBOR SOUTH JETTY		28	
	FLORIDA	13 PORT EVERGLADES HARBOR	PORT EVERGLADES HARBOR NORTH JETTY	118,600	29	
			PORT EVERGLADES HARBOR SOUTH JETTY		30	
	CALIFORNIA	14 RICHMOND HARBOR	RICHMOND HARBOR BREAKWATER	106,087	31	
	FLORIDA	15 JACKSONVILLE HARBOR	JACKSONVILLE HARBOR NORTH JETTY	100,452	32	
			JACKSONVILLE HARBOR SOUTH JETTY		33	
	CALIFORNIA	16 OAKLAND HARBOR	OAKLAND HARBOR NORTH JETTY	66,523	34	
			OAKLAND HARBOR SOUTH JETTY		35	



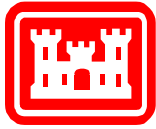
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# Commodities Breakdown

Commodities Breakdown for Savannah Harbor







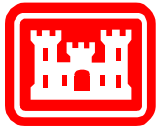
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# Global Ranking

CSMART									
Step 1: Features   Step 2: Locations   Step 3: Execute Query   Step 4: View Results   Step 5: Google Earth   Preferences									
Tonnage   Fishing   Coast Guard   Dredging   Boat Ramp   Global Ranking									
Feature	Weight								
Tonnage	0.25								
Fishing	0.25								
Coast Guard	0.25								
Dredging	0.25								
Rank >>									
Ranking	Ranking Details	Structure							
0.340	(Tonnage: 0.963 * 0.25) + (Fishing: 0.178 * 0.25) + (Coast Guard: 0.218 * 0.25) + (Dredging: 0.000 * 0.25)	GALVESTON HARBOR NORTH JETTY							
0.306	(Tonnage: 0.963 * 0.25) + (Fishing: 0.178 * 0.25) + (Coast Guard: 0.095 * 0.25) + (Dredging: 0.028 * 0.25)	GALVESTON HARBOR SOUTH JETTY							
0.298	(Tonnage: 0.000 * 0.25) + (Fishing: 0.191 * 0.25) + (Coast Guard: 1.000 * 0.25) + (Dredging: 0.000 * 0.25)	SITKA HARBOR JETTY							
0.293	(Tonnage: 0.000 * 0.25) + (Fishing: 0.191 * 0.25) + (Coast Guard: 0.982 * 0.25) + (Dredging: 0.000 * 0.25)	SITKA HARBOR BREAKWATER							
0.290	(Tonnage: 0.097 * 0.25) + (Fishing: 0.046 * 0.25) + (Coast Guard: 0.018 * 0.25) + (Dredging: 1.000 * 0.25)	JACKSONVILLE HARBOR NORTH JETTY							
0.290	(Tonnage: 0.097 * 0.25) + (Fishing: 0.046 * 0.25) + (Coast Guard: 0.018 * 0.25) + (Dredging: 1.000 * 0.25)	JACKSONVILLE HARBOR SOUTH JETTY							
0.256	(Tonnage: 0.000 * 0.25) + (Fishing: 1.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.025 * 0.25)	CAPE COD CANAL STONY POINT DIKE							
0.250	(Tonnage: 0.000 * 0.25) + (Fishing: 1.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	CUTTYHUNK HARBOR NORTH JETTY							
0.250	(Tonnage: 0.000 * 0.25) + (Fishing: 1.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	CUTTYHUNK HARBOR SOUTH JETTY							
0.250	(Tonnage: 0.000 * 0.25) + (Fishing: 1.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	CUTTYHUNK HARBOR CANAPITSIT BEACH STONE DIKE							
0.250	(Tonnage: 0.000 * 0.25) + (Fishing: 1.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	CUTTYHUNK HARBOR COPICUT NECK STONE DIKE							
0.250	(Tonnage: 1.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	SOUTHWEST PASS EAST JETTY							
0.250	(Tonnage: 1.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	SOUTHWEST PASS WEST JETTY							
0.250	(Tonnage: 0.000 * 0.25) + (Fishing: 1.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	WESTPORT HARBOR BREAKWATER							
0.233	(Tonnage: 0.064 * 0.25) + (Fishing: 0.046 * 0.25) + (Coast Guard: 0.018 * 0.25) + (Dredging: 0.805 * 0.25)	OAKLAND HARBOR NORTH JETTY							
0.233	(Tonnage: 0.064 * 0.25) + (Fishing: 0.046 * 0.25) + (Coast Guard: 0.018 * 0.25) + (Dredging: 0.805 * 0.25)	OAKLAND HARBOR SOUTH JETTY							
0.219	(Tonnage: 0.001 * 0.25) + (Fishing: 0.457 * 0.25) + (Coast Guard: 0.418 * 0.25) + (Dredging: 0.000 * 0.25)	KODIAK HARBOR SOUTHWEST BREAKWATER							
0.214	(Tonnage: 0.001 * 0.25) + (Fishing: 0.457 * 0.25) + (Coast Guard: 0.400 * 0.25) + (Dredging: 0.000 * 0.25)	KODIAK HARBOR SOUTHEAST BREAKWATER							
0.200	(Tonnage: 0.000 * 0.25) + (Fishing: 0.178 * 0.25) + (Coast Guard: 0.600 * 0.25) + (Dredging: 0.020 * 0.25)	PORT BOLIVAR DIKE							
0.174	(Tonnage: 0.114 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.582 * 0.25) + (Dredging: 0.000 * 0.25)	PORT EVERGLADES HARBOR SOUTH JETTY							
0.174	(Tonnage: 0.623 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.073 * 0.25) + (Dredging: 0.000 * 0.25)	LA-LB HARBORS MIDDLE BREAKWATER							
0.169	(Tonnage: 0.114 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.564 * 0.25) + (Dredging: 0.000 * 0.25)	PORT EVERGLADES HARBOR NORTH JETTY							
0.169	(Tonnage: 0.623 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.055 * 0.25) + (Dredging: 0.000 * 0.25)	LA-LB HARBORS SAN PEDRO BREAKWATER							
0.167	(Tonnage: 0.135 * 0.25) + (Fishing: 0.187 * 0.25) + (Coast Guard: 0.345 * 0.25) + (Dredging: 0.000 * 0.25)	PORTLAND HARBOR NORTH (INNER HARBOR) BREAKWATER							
0.156	(Tonnage: 0.623 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	LA-LB HARBORS LONG BEACH BREAKWATER							
0.156	(Tonnage: 0.010 * 0.25) + (Fishing: 0.083 * 0.25) + (Coast Guard: 0.073 * 0.25) + (Dredging: 0.457 * 0.25)	COOS BAY SPUR JETTY							
0.150	(Tonnage: 0.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.600 * 0.25) + (Dredging: 0.000 * 0.25)	VALDEZ HARBOR EAST BREAKWATER							
0.150	(Tonnage: 0.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.600 * 0.25) + (Dredging: 0.000 * 0.25)	VALDEZ HARBOR WEST BREAKWATER							
0.149	(Tonnage: 0.001 * 0.25) + (Fishing: 0.165 * 0.25) + (Coast Guard: 0.364 * 0.25) + (Dredging: 0.065 * 0.25)	BAYOU LAFOURCHE DIKE							
0.149	(Tonnage: 0.001 * 0.25) + (Fishing: 0.165 * 0.25) + (Coast Guard: 0.364 * 0.25) + (Dredging: 0.065 * 0.25)	BAYOU LAFOURCHE GROIN							
0.142	(Tonnage: 0.000 * 0.25) + (Fishing: 0.231 * 0.25) + (Coast Guard: 0.309 * 0.25) + (Dredging: 0.028 * 0.25)	KEY WEST HARBOR BREAKWATER							
0.135	(Tonnage: 0.102 * 0.25) + (Fishing: 0.046 * 0.25) + (Coast Guard: 0.036 * 0.25) + (Dredging: 0.355 * 0.25)	RICHMOND HARBOR BREAKWATER							
0.124	(Tonnage: 0.000 * 0.25) + (Fishing: 0.126 * 0.25) + (Coast Guard: 0.327 * 0.25) + (Dredging: 0.043 * 0.25)	YAQUINA BAY NORTH JETTY							
0.119	(Tonnage: 0.015 * 0.25) + (Fishing: 0.280 * 0.25) + (Coast Guard: 0.036 * 0.25) + (Dredging: 0.144 * 0.25)	BRAZOS ISLAND NORTH JETTY							
0.119	(Tonnage: 0.015 * 0.25) + (Fishing: 0.280 * 0.25) + (Coast Guard: 0.036 * 0.25) + (Dredging: 0.144 * 0.25)	BRAZOS ISLAND SOUTH JETTY							
0.117	(Tonnage: 0.000 * 0.25) + (Fishing: 0.033 * 0.25) + (Coast Guard: 0.436 * 0.25) + (Dredging: 0.000 * 0.25)	ANACORTES HARBOR SOUTH BREAKWATER							
0.117	(Tonnage: 0.000 * 0.25) + (Fishing: 0.033 * 0.25) + (Coast Guard: 0.436 * 0.25) + (Dredging: 0.000 * 0.25)	ANACORTES HARBOR SOUTHEAST BREAKWATER							
0.117	(Tonnage: 0.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.436 * 0.25) + (Dredging: 0.032 * 0.25)	EAST PASS CHANNEL WEST SAND DIKE							
0.111	(Tonnage: 0.000 * 0.25) + (Fishing: 0.099 * 0.25) + (Coast Guard: 0.345 * 0.25) + (Dredging: 0.000 * 0.25)	BELLINGHAM HARBOR EAST BREAKWATER							
0.111	(Tonnage: 0.000 * 0.25) + (Fishing: 0.099 * 0.25) + (Coast Guard: 0.345 * 0.25) + (Dredging: 0.000 * 0.25)	BELLINGHAM HARBOR EXPANSION BREAKWATER							
0.111	(Tonnage: 0.129 * 0.25) + (Fishing: 0.047 * 0.25) + (Coast Guard: 0.109 * 0.25) + (Dredging: 0.159 * 0.25)	FREEPORT HARBOR SOUTH JETTY							
0.111	(Tonnage: 0.150 * 0.25) + (Fishing: 0.196 * 0.25) + (Coast Guard: 0.073 * 0.25) + (Dredging: 0.026 * 0.25)	COLUMBIA RIVER AT MOUTH JETTY A							
0.110	(Tonnage: 0.423 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.018 * 0.25) + (Dredging: 0.000 * 0.25)	SABINE PASS WEST JETTY							
0.108	(Tonnage: 0.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.291 * 0.25) + (Dredging: 0.142 * 0.25)	BAKERS HAULOVER INLET NORTH JETTY							
0.107	(Tonnage: 0.001 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.364 * 0.25) + (Dredging: 0.065 * 0.25)	BAYOU LAFOURCHE WEST JETTY							
0.106	(Tonnage: 0.423 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	SABINE PASS EAST JETTY							
0.103	(Tonnage: 0.000 * 0.25) + (Fishing: 0.229 * 0.25) + (Coast Guard: 0.182 * 0.25) + (Dredging: 0.000 * 0.25)	POINT JUDITH WEST SHORE ARM BREAKWATER							
0.101	(Tonnage: 0.010 * 0.25) + (Fishing: 0.083 * 0.25) + (Coast Guard: 0.055 * 0.25) + (Dredging: 0.258 * 0.25)	COOS BAY NORTH JETTY							
0.101	(Tonnage: 0.010 * 0.25) + (Fishing: 0.083 * 0.25) + (Coast Guard: 0.055 * 0.25) + (Dredging: 0.258 * 0.25)	COOS BAY SOUTH JETTY							
0.101	(Tonnage: 0.000 * 0.25) + (Fishing: 0.039 * 0.25) + (Coast Guard: 0.200 * 0.25) + (Dredging: 0.164 * 0.25)	OCEAN CITY INLET NORTH JETTY							
0.101	(Tonnage: 0.000 * 0.25) + (Fishing: 0.039 * 0.25) + (Coast Guard: 0.200 * 0.25) + (Dredging: 0.164 * 0.25)	OCEAN CITY INLET SOUTH JETTY							
0.099	(Tonnage: 0.000 * 0.25) + (Fishing: 0.033 * 0.25) + (Coast Guard: 0.364 * 0.25) + (Dredging: 0.000 * 0.25)	SHILSHOLE BAY BREAKWATER							
0.097	(Tonnage: 0.000 * 0.25) + (Fishing: 0.207 * 0.25) + (Coast Guard: 0.182 * 0.25) + (Dredging: 0.000 * 0.25)	GLOUCESTER HARBOR, DOG BAR BREAKWATER							
0.096	(Tonnage: 0.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.018 * 0.25) + (Dredging: 0.364 * 0.25)	FIRE ISLAND INLET JETTY							
0.095	(Tonnage: 0.000 * 0.25) + (Fishing: 0.000 * 0.25) + (Coast Guard: 0.000 * 0.25) + (Dredging: 0.000 * 0.25)	CHAMBERLAND HARBOR NORTH JETTY							

Status:

- Selected Feature
- Selected Location



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